General

Guideline Title

Congress of Neurological Surgeons systematic review and evidence-based guideline on preoperative imaging assessment of patients with suspected nonfunctioning pituitary adenomas.

Bibliographic Source(s)

Chen CC, Carter BS, Wang R, Patel KS, Hess C, Bodach ME, Tumialan LM, Oyesiku NM, Patil CG, Litvack Z, Zada G, Aghi MK. Congress of Neurological Surgeons systematic review and evidence-based guideline on preoperative imaging assessment of patients with suspected nonfunctioning pituitary adenomas. Neurosurgery. 2016 Oct;79(4):E524-6. [24 references] PubMed

Guideline Status

This is the current release of the guideline.

This guideline meets NGC's 2013 (revised) inclusion criteria.

Recommendations

Major Recommendations

The rating schemes used for the strength of the evidence (Class I-III) and the levels of recommendation (Level I-III) are defined at the end of the "Major Recommendations" field.

Question

What imaging modality should be carried out in the preoperative diagnosis of nonfunctioning pituitary adenomas (NFPAs)?

Target Population

These recommendations apply to adults with imaging findings, signs, and symptoms suggestive of an NFPA.

Recommendation

High-resolution magnetic resonance imaging (MRI) (Level II) is recommended as the standard but may be supplemented with computed tomography (CT) (Level III).

Question

What imaging modalities can be used to preoperatively evaluate NFPA histology and characteristics?

Target Population

These recommendations apply to adults with imaging findings, signs, and symptoms suggestive of an NFPA.

Recommendation

While promising results are available pertaining to magnetic resonance (MR) spectroscopy, MR perfusion, positron-emission tomography (PET), and single-photon emission tomography (SPECT) for preoperative assessment of NFPA histology and characteristics, there is insufficient evidence to make a formal recommendation for their use.

Question

What imaging modalities can be used to preoperatively evaluate cavernous sinus invasion?

Target Population

These recommendations apply to adults with imaging findings, signs, and symptoms suggestive of an NFPA.

Recommendation

While promising results are available pertaining to high-resolution MR and proton density imaging as tools of assessing cavernous sinus invasion, there is insufficient evidence to make a formal recommendation for their use.

Question

What imaging modality can be used to preoperatively evaluate tumor vascularity and hemorrhage?

Target Population

These recommendations apply to adults with imaging findings, signs, and symptoms suggestive of an NFPA.

Recommendation

While promising results are available pertaining to perfusion and gradient echo imaging as tools for assessing tumor vascularity and hemorrhage, there is insufficient evidence to make a formal recommendation for their use.

Definitions

Evidence Classification for Diagnostic Studies

Class I	Evidence provided by one or more well-designed clinical studies of a *diverse* population using a "gold standard" reference test in a blinded evaluation appropriate for the diagnostic applications and enabling the assessment of sensitivity, specificity, positive and negative predictive values, and, where applicable, likelihood ratios
Class II	Evidence provided by one or more well-designed clinical studies of a *restricted* population using a "gold standard" reference test in a blinded evaluation appropriate for the diagnostic applications and enabling the assessment of sensitivity, specificity, positive and negative predictive values, and, where applicable, likelihood ratios
Class III	Evidence provided by expert opinion or studies that do not meet the criteria for the delineation of sensitivity, specificity, positive and negative predictive values, and, where applicable, likelihood ratios

Evidence Classification for Prognostic Studies

In order to evaluate papers addressing prognosis, five technical criteria are applied:

- Was a well-defined representative sample of patients assembled at a common (usually early) point in the course of their disease?
- Was patient follow-up sufficiently long and complete?
- Were objective outcome criteria applied in a "blinded" fashion?
- If subgroups with different prognoses were identified, was there adjustment for important prognostic factors?
- If specific prognostic factors were identified, was there validation in an independent "test set" group of patients?

Class I - All 5 technical criteria above are satisfied.

Class II - Four of five technical criteria are satisfied.

Class III - Everything else.

Strength of Recommendations Rating Scheme

Level I: High degree of clinical certainty (Class I evidence or overwhelming Class II evidence)

Level II: Clinical certainty (Class II evidence or a strong consensus of Class III evidence)

Level III: Clinical uncertainty (inconclusive or conflicting evidence or opinion)

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

Nonfunctioning pituitary adenoma (NFPA)

Guideline Category

Diagnosis

Evaluation

Clinical Specialty

Endocrinology

Neurological Surgery

Neurology

Oncology

Radiology

Intended Users

Physicians

Guideline Objective(s)

To summarize the key studies that impact the clinical utilization of neuroimaging in the preoperative management of nonfunctioning pituitary adenomas (NFPAs)

Target Population

Adults with imaging findings, signs, and symptoms suggestive of a nonfunctioning pituitary adenoma (NFPA)

Interventions and Practices Considered

1. High-resolution magnetic resonance imaging (MRI)
2. Computed tomography (CT)

Note: The following were considered but not recommended: magnetic resonance (MR) spectroscopy, MR perfusion, positron emission tomography (PET), and single-photon emission computed tomography (SPECT) for preoperative assessment of nonfunctioning pituitary adenoma (NFPA) histology and characteristics; high-resolution MR and proton density imaging as tools of assessing cavernous sinus invasion; and perfusion and gradient echo imaging as tools for assessing tumor vascularity and hemorrhage.

Major Outcomes Considered

- Utility of imaging procedures in preoperative assessment
- Sensitivity, specificity and positive/negative predictive value of imaging procedures in preoperative assessment

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

General Search Strategy

Literature Searches

The guideline task force collaborated with a medical librarian to search for articles published from January 1, 1966, to October 1, 2014. Searches were conducted in two electronic databases, PubMed and The Cochrane Central Register of Controlled Trials. Strategies for searching electronic databases were constructed by the guideline task force members and medical/research librarians using previously published search strategies to identify relevant studies. The root search strategies are provided in Appendix A of the introduction and methodology companion and the chapter-specific search strategies are provided in the appendix of the full version of the guideline (see the "Availability of Companion Documents" field).

The searches of electronic databases were supplemented with manual screening of the bibliographies of all retrieved publications. The bibliographies of recent systematic reviews and other review articles for potentially relevant citations were also screened. All articles identified were subject to the study selection criteria listed below. The guideline task force also examines lists of included and excluded studies for errors and omissions.

Article Inclusion Criteria

Articles were retrieved and included only if they met specific inclusion criteria. These criteria were also applied to articles provided by the evidence-based clinical practice guideline task force members who supplemented the electronic database searches with manual searches of the bibliographies. To reduce bias, these criteria were specified *a priori* before conducting the literature searches. For the purposes of this guideline, articles had to meet the following criteria to be included as evidence to support the recommendations presented in this guideline:

- Investigated patients suspected of having a pituitary mass
- Enrolled patients ≥18 years of age
- Either enrolled exclusively nonfunctioning pituitary adenoma (NFPA) patients OR combined the results of patients with NFPAs and functioning pituitary adenomas and/or other pituitary masses with ≥90% of the patients having NFPAs
- Was a full article report of a clinical study
- If a prospective case series, reported baseline values
- Appeared in a peer-reviewed publication
- Enrolled ≥10 NFPA patients per arm per intervention (20 total) for each outcome

- Was of humans
- Was published in or after 1966
- Quantitatively presented results

Article Exclusion Criteria

Articles of the following types were excluded as evidence to support the recommendations presented in this guideline:

- In vitro studies
- Studies performed on cadavers
- Studies not published in English
- Medical records reviews, meeting abstracts, historical articles, editorial, letters, or commentaries
- Systematic reviews, meta-analyses, or guidelines developed by others

Specific Methods for This Guideline

Literature Search

The task force collaborated with a medical librarian to search for articles published from January 1, 1966, to October 1, 2014 in both PubMed and The Cochrane Central Register of Controlled Trials. Strategies for searching electronic databases were constructed by the guideline taskforce members and the medical librarian using previously published search strategies to identify relevant studies (see Appendix A in the full guideline).

Study Selection

An independent reviewer evaluated the initial 5598 citations using the criteria described above. Articles were excluded for the following reasons: 905 articles were not written in English, 82 articles involved only animal studies, 1810 articles were case reports, 1465 articles did not involve NFPAs, 998 articles did not involve imaging, 48 studies described postoperative assessment of NFPAs, and 55 studies described the use of intraoperative magnetic resonance images (MRIs). After these exclusions, 235 articles were evaluated in detail for the purpose of this review. The same eligibility criteria were used for full-text screening of potentially relevant papers.

Number of Source Documents

Overall, 122 studies met the eligibility criteria for the systematic review, including 8 studies producing Class II data and 114 studies producing Class III data related to preoperative imaging for nonfunctioning pituitary adenomas (NFPAs).

See Figure 1 in the full version of the guideline for the flowchart summarizing study selection (see the "Availability of Companion Documents" field).

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Evidence Classification for Diagnostic Studies

Class I	Evidence provided by one or more well-designed clinical studies of a *diverse* population using a "gold standard" reference test in a blinded evaluation appropriate for the diagnostic applications and enabling the assessment of sensitivity, specificity, positive and negative predictive values, and, where applicable, likelihood ratios
Class II	Evidence provided by one or more well-designed clinical studies of a *restricted* population using a "gold standard" reference test in a blinded evaluation appropriate for the diagnostic applications and enabling the assessment of sensitivity, specificity, positive and negative predictive values, and, where applicable, likelihood ratios
Class III	Evidence provided by expert opinion or studies that do not meet the criteria for the delineation of sensitivity, specificity, positive and negative predictive values, and, where applicable, likelihood ratios

Evidence Classification for Prognostic Studies

In order to evaluate papers addressing prognosis, five technical criteria are applied:

- Was a well-defined representative sample of patients assembled at a common (usually early) point in the course of their disease?
- Was patient follow-up sufficiently long and complete?
- Were objective outcome criteria applied in a "blinded" fashion?
- If subgroups with different prognoses were identified, was there adjustment for important prognostic factors?
- If specific prognostic factors were identified, was there validation in an independent "test set" group of patients?

Class I - All 5 technical criteria above are satisfied.

Class II - Four of five technical criteria are satisfied.

Class III - Everything else.

Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

Rating the Quality of the Evidence and Levels of Recommendations

The quality and classification of evidence (see the "Rating Scheme for the Strength of the Evidence" field) was rated using an evidence hierarchy developed by the American Association of Neurological Surgeons/Congress of Neurological Surgeons (AANS/CNS) Guidelines Committee for each of four different study types: therapeutic, prognostic, diagnostic, and economic or decision modeling. The methodology used to conduct quality evaluations of the evidence can be located on the CNS Web site (see also the "Availability of Companion Documents" field). The level/strength of recommendation (i.e., Level I, II, or III) was linked to the quality of the overall body of evidence included in the chapter and in support of a given recommendation.

Methods Used to Formulate the Recommendations

Expert Consensus (Nominal Group Technique)

Description of Methods Used to Formulate the Recommendations

Process Overview

A multidisciplinary task force comprised of physician volunteers and evidence-based medicine trained methodologists conducted a systematic review of the literature relevant to the management of non-functioning pituitary adenomas (NFPAs). The physician volunteers represented neurosurgeons, neuro-ophthalmologists, neuroradiologists, and endocrinologists with expertise in pituitary adenomas. The evidence-based medicine trained methodologists had previous experience in guidelines production for the Joint Guidelines Committee (JGC) of the Congress of Neurological Surgeons (CNS) and the American Association of Neurological Surgeons (AANS). During the development process, the task force participated in a series of conference calls and meetings. Multiple iterations of written review were conducted by the individuals of the panel and various CNS/AANS Committees prior to approval.

Guideline Task Force Panel Consensus

The guideline task force panel included context experts from multiple disciplines and various areas of therapy to address the topics addressed in this guideline. Sub-task force members were assigned to a specific chapter and were involved in the literature review, the creation and editing of the evidence tables, reviewing and voting of the final recommendations.

Voting on the Recommendations

The task force used a structured voting technique to finalize and approve the final recommendations, language, and strength of recommendations, presented in the review. The voting technique is referred to as the nominal group technique. This technique includes up to three rounds of voting,

using secret ballots to ensure task force members are blinded to the responses of other task force members. All the recommendations in this review were approved following the first round of voting and no further discussion was needed to finalize the recommendations. During the course of editing and finalization of the document, changes were made to allow recommendations to conform to the rules of evidence and language as described above. When this occurred, the changes were reviewed and approved by the group.

Rating Scheme for the Strength of the Recommendations

Strength of Recommendations Rating Scheme

Level I: High degree of clinical certainty (Class I evidence or overwhelming Class II evidence)

Level II: Clinical certainty (Class II evidence or a strong consensus of Class III evidence)

Level III: Clinical uncertainty (inconclusive or conflicting evidence or opinion)

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

External Peer Review

Internal Peer Review

Description of Method of Guideline Validation

Guideline Approval Process

The guideline draft was circulated to the entire task force for final review and approval prior to submission for peer review by the Joint Guidelines Committee (JGC) of the Congress of Neurological Surgeons (CNS) and the American Association of Neurological Surgeons (AANS). Due to the reviewers' knowledge of evidence-based medicine and clinical practice guidelines methodology training, the JGC peer reviewers served as the journal's editorial reviewers. As a part of the JGC review process, the reviewers provided input on the content of the guideline and suggested revisions prior to approval and endorsement of the draft guideline by the CNS and AANS prior to publication. The development of this guideline was editorially independent from the funding agencies (CNS Executive Committee, and AANS/CNS Joint Tumor Section Executive Committee), the CNS and Joint Tumor Section.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

Overall, 8 studies producing Class II data and 114 studies producing Class III data were included in this systematic review.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

A wide range of anatomic and functional imaging modalities is currently available for preoperative assessment of nonfunctioning pituitary adenomas. Understanding the benefits and limitations of these modalities should afford opportunities for judicious clinical application, with the goal of

optimizing patient care.

Potential Harms

Not stated

Qualifying Statements

Qualifying Statements

Disclaimer of Liability

This clinical systematic review and evidence-based guideline was developed by a physician volunteer task force as an educational tool that reflects the current state of knowledge at the time of completion. The presentations are designed to provide an accurate review of the subject matter covered. This guideline is disseminated with the understanding that the recommendations by the authors and consultants who have collaborated in its development are not meant to replace the individualized care and treatment advice from a patient's physician(s). If medical advice or assistance is required, the services of a physician should be sought. The recommendations contained in this guideline may not be suitable for use in all circumstances. The choice to implement any particular recommendation contained in this guideline must be made by a managing physician in light of the situation in each particular patient and on the basis of existing resources.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Mobile Device Resources

Quick Reference Guides/Physician Guides

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Living with Illness

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Chen CC, Carter BS, Wang R, Patel KS, Hess C, Bodach ME, Tumialan LM, Oyesiku NM, Patil CG, Litvack Z, Zada G, Aghi MK. Congress of Neurological Surgeons systematic review and evidence-based guideline on preoperative imaging assessment of patients with suspected nonfunctioning pituitary adenomas. Neurosurgery. 2016 Oct;79(4):E524-6. [24 references] PubMed

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2016 Oct

Guideline Developer(s)

Congress of Neurological Surgeons - Professional Association

Source(s) of Funding

These evidence-based clinical practice guidelines were funded exclusively by the Congress of Neurological Surgeons and the Tumor Section of the Congress of Neurological Surgeons and the American Association of Neurological Surgeons, which received no funding from outside commercial sources to support the development of this document.

Guideline Committee

Nonfunctioning Pituitary Adenoma Guideline Task Force

Composition of Group That Authored the Guideline

Authors: Clark C. Chen, MD, PhD, Center for Theoretical and Applied Neuro-Oncology, Division of Neurosurgery, University of California, San Diego, San Diego, California, USA; Bob S. Carter, MD, PhD, Center for Theoretical and Applied Neuro-Oncology, Division of Neurosurgery, University of California, San Diego, San Diego, California, USA; Renzhi Wang, MD, Department of Neurosurgery, Peking Union Medical College Hospital, Beijing, China; Kunal S. Patel, BA, Center for Theoretical and Applied Neuro-Oncology, Division of Neurosurgery, University of California, San Diego, San Diego, California, USA; Christopher Hess, MD, PhD, Department of Radiology and Biomedical Imaging, University of California, San Francisco, San Francisco, California, USA; Mary E. Bodach, MLIS, Guidelines Department, Congress of Neurological Surgeons, Schaumburg, Illinois, USA; Luis M. Tumialan MD, Barrow Neurological Institute, Phoenix, Arizona, USA; Nelson M. Oyesiku, MD, PhD, Department of Neurosurgery, Emory University, Atlanta, Georgia, USA; Chirag G. Patil, MD, Department of Neurosurgery, Cedars-Sinai Medical Center, Los Angeles, California, USA; Zachary Litvack MD, Department of Neurosurgery, George Washington University, Washington, DC, USA; Gabriel Zada, MD, Department of Neurological Surgery, University of Southern California, Los Angeles, California, USA; Manish K. Aghi, MD, PhD, Department of Neurosurgery, University of California, San Francisco, San Francisco, California, USA

Financial Disclosures/Conflicts of Interest

Potential Conflicts of Interest

All Nonfunctioning Pituitary Adenoma (NFPA) Guideline Task Force members were required to disclose all potential conflicts of interest (COIs) prior to beginning work on the guideline, using the COI disclosure form of the American Association of Neurological Surgeons/Congress of Neurological Surgeons (AANS/CNS) Joint Guidelines Committee. The CNS Guidelines Committee and Guideline Task Force Chair reviewed the disclosures and either approved or disapproved the nomination and participation on the task force. The CNS Guidelines Committee and Guideline

Task Force Chair may approve nominations of Task Force Members with possible conflicts and restrict the writing, reviewing and/or voting privileges of that person to topics that are unrelated to the possible COIs.

Disclosures

The authors have no personal, financial, or institutional interest in any of the drugs, materials, or devices described in this article.

Guideline Endorser(s)

American Association of Neurological Surgeons - Medical Specialty Society

Guideline Status

This is the current release of the guideline.

This guideline meets NGC's 2013 (revised) inclusion criteria.

Guideline Availability

Available from the Neurosurgery Web site . Also available in ePub format from the Neurosurgery Web site .

Availability of Companion Documents

The following are available:

- Chen CC, Carter BS, Wang R, Patel KS, Hess C, Bodach ME, Tumialan LM, Oyesiku NM, Patil CG, Litvack Z, Zada G, Aghi MK. Congress of Neurological Surgeons systematic review and evidence-based guideline on preoperative imaging assessment of patients with suspected nonfunctioning pituitary adenomas. Full guideline. Schaumburg (IL): Congress of Neurological Surgeons (CNS); 2016 Oct. 115 p. Available from the Congress of Neurological Surgeons (CNS) Web site .
- Aghi MK, Chen CC, Fleseriu M, Newman SA, Lucas JW, Kuo JS, Barkhoudarian G, Farrell CJ, Sheehan J, Ziu M, Dunn IF. Congress of Neurological Surgeons systematic review and evidence-based guidelines on the management of patients with nonfunctioning pituitary adenomas: executive summary. Neurosurgery. 2016 Oct;79(4):521-3. Available from the Neurosurgery Web site .
- Aghi MK, Bodach ME, Tumialan LM, Oyesiku NM, Patil CG, Litvack Z, Zada G. Congress of Neurological Surgeons systematic review and evidence-based guidelines on the management of patients with nonfunctioning pituitary adenomas: introduction and methodology. Schaumburg (IL): Congress of Neurological Surgeons (CNS); 2016 Oct. 12 p. Available from the CNS Web site .
- Congress of Neurological Surgeons (CNS). Guideline development methodology: endorsed by the American Association of Neurological Surgeons (AANS), the Congress of Neurological Surgeons (CNS), and the AANS/CNS Joint Guideline Committee. Schaumburg (IL): Congress of Neurological Surgeons (CNS); 2012 Feb. 12 p. Available from the CNS Web site .

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on February 10, 2017. The information was verified by the guideline developer on February 22, 2017.

Copyright Statement

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